MAGNETIC SIGNATURE OF NWA 5029: A BASALTIC SHERGOTTITE RELATED TO NWA 480/1460

V.H. Hoffmann[1,2], T. Mikouchi[3], M. Torii[4], M. Funaki[5], R. Hochleitner[6]; [1]Dept. Geosciences, Univ. Tuebingen, Sigwartstr. 10, 72076 Tuebingen, Germany; [2]Dept. Geo.-Env. Sciences, Univ. Munich, Germany; [3]Dept. Earth Planet. Sci., Univ. Tokyo, Japan; [4]Dept. Geosph.-Biosph.-Syst. Sci., Okayama Univ. Sci., Japan; [5]NIPR, Tokyo, Japan. [6]Mineralogical State Collection, Munich, Germany. Email: hoffmann.viktor@gmx.net

Introduction: Northwest Africa 5029 is a small, unpaired 14.67gr partly fusion-crusted stone which was found in Marocco in 2003 and classified as a basaltic shergottite [1] (diabasic-mafic-intermediate shergottite [2]). Here we report its magnetic properties and compare the data with NWA480/1460, a diabasic/ basaltic shergottite with similar mineralogy and texture [3, 4]. The opaque minerals have been identified and investigated by optical microscopy and EMPA.

Samples and investigations: We used several chips and fragments of the type mass (~1.4gr) of NWA 5029 for the magnetic experiments. For comparison, chips of NWA 480 (plus fragments) and NWA 1460 (both paired) were used. First magnetic data of NWA 480/1460 have been published by [5], whereby NWA 1460 corresponds to the sample of this study.

Results: The natural remanent magnetization (NRM) of NWA 5029 could be attributed to impact shock related processes on Mars, eventually resulting from the last and ejecting event, representing an SRM (shock remanent magnetization). The NWA 480/1460 NRM is most likely of terrestrial origin, an IRM which might be due to remagnetisation by the use of hand magnets already in field by the nomads. The magnetic susceptibility (MS) values of the three stones are in the range which was found by [6] for Martian meteorites, and typical for diabasic/basaltic shergottites. The degree of anisotropy of magnetic susceptibility (AMS) is quite low in all cases (P between 1.071 and 1.090) despite the high degree of shock which should be reflected by the AMS. In the low-temperature range all three samples show essentially identical behaviour: two magnetic transitions are detected in the range of 40-60K (ilmenite and/or chromite) and at 120K (magnetite) in both FC and ZFC IRM curves.

Discussion and conclusion: The magnetic remanences (NRM) in these shergottites are carried by pure magnetite (Fe_3O_4) with a Curie-temperature (T_c) of about 575°C. In agreement with other data, the magnetite is apparently exsolved (magnetite with ilmenite lamellae), that is, high-temperature oxidized titano-magnetite. Minor effects are related to substituted magnetite with a T_c of about 525°C. Fe-sulfides such as monoclinic pyrrhotite (Fe_7S_8) could not be detected. The magnetic signature and texture of all three stones is very similar which leads to our hypothesis that the three rocks are very likely launch paired. We can conclude that the high-temperature oxidation occurred on the surface of Mars either during the primary formation processes or as a result of shock (at least 35 GPa) from the event which ejected the meteorites from the Mars surface into space.

References: [1] Mikouchi T., Barrat J.A., 2009. 72nd Ann. Meteor. Soc. Meeting, #5344. [2] Irving A., 2011. http://www.imca.cc/mars/martian-meteorites.htm. [3] Barrat J.A. et al., 2002. Meteor. Planet. Sci., 37: 487-499. [4] Irving A. and Kuehner S., 2003. Lunar Planet. Sci. Conf., XXXIV, #1503. [5] Rochette P. et al., 2005. Meteor. Planet. Sci., 40/4: 529-540. [6] Rochette P. et al., 2009. Meteor. Planet. Sci., 44: 405-427.